

Focussed Ultrasound

The other major method of delivering HIFU to a predetermined site in the body is by focussing the waves at the desired location in the manner similar to that sketched in figure 1. Focussed ultrasound is now used (or proposed to be used) in a broad range of clinical therapies. Often the patient is submerged in a water bath so that the surroundings closely match the acoustic impedance of the body and thus improve the focussing of the waves (reducing the focal volume). Here again there are several broad strategies:

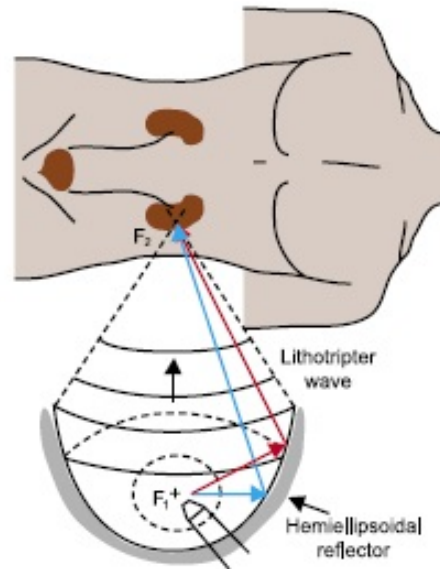


Figure 1: Schematic of lithotripter or HIFU therapy.

Modest amplitudes in the focal region are commonly used to cause produce heating while avoiding cavitation. For example, this is used for *hemostasis*, to stop bleeding in internal organs (Vaezy *et al.* (1999)) such as the liver (Vaezy *et al.* (1997)) or spleen (Vaezy *et al.* (1999)). It can also be used for *tumor necrosis* (Garrison *et al.* (1994)), thermally ablating tumors in a minimally invasive fashion. Ultrasound has also been used to help break up blood clots in a therapy known as *sonothrombolysis* (Crum *et al.* (2009), Bailey *et al.* (2003), Alexandrov *et al.* (2000)). In most of these treatments, the amplitudes are designed to be small enough to avoid cavitation which could cause too much collateral damage. However, we will focus here primarily on those strategies that involve more powerful waves that produce and use cavitation.